



# CAPT “Dino” Ferrari Naval Research Laboratory



The Navy and Marine Corps Corporate Laboratory



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“GOVERNMENT SHOULD MAINTAIN A GREAT RESEARCH LABORATORY TO DEVELOP GUNS, NEW EXPLOSIVES AND ALL THE TECHNIQUE OF MILITARY AND NAVAL PROGRESSION WITHOUT ANY VAST EXPENSE.”

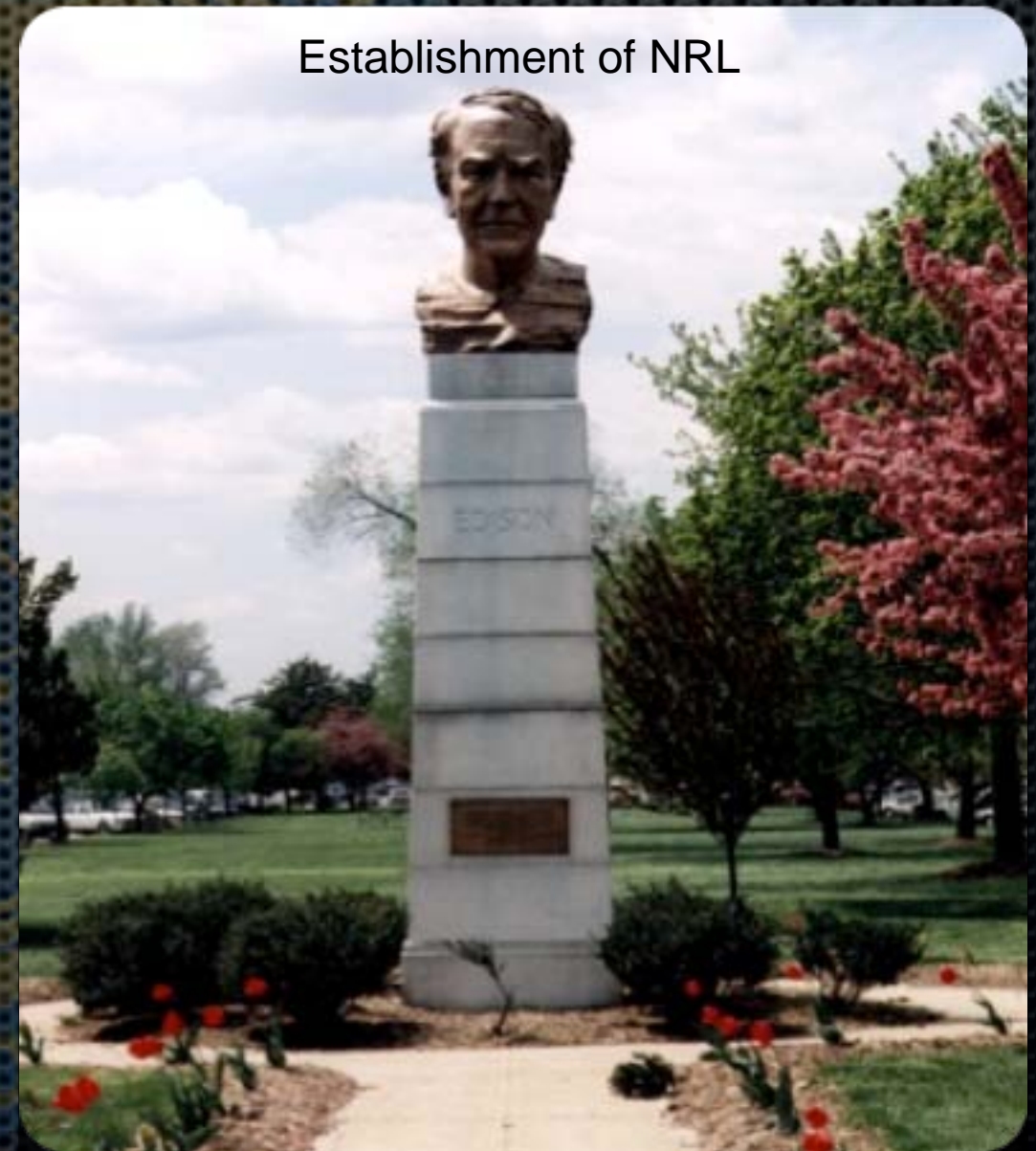
# THOMAS A. EDISON

THE NEW YORK TIMES MAGAZINE  
SUNDAY, MAY 30, 1915

## A WORLD-CLASS LABORATORY

- The sinking of the British ocean liner Lusitania, May 7, 1915 (128 US fatalities)
  - SECNAV Daniels established Naval Consulting Board with Edison Chair, meeting October 7, 1915
- “ For utilizing the natural inventive genius of Americans to meet the new conditions of warfare as shown abroad ...”*
- August 29, 1916 Congress appropriates funds to establish the Lab
  - Delayed by WW-I, Assistant Secretary of the Navy, Theodore Roosevelt, Jr. Commissions the Lab at Bellevue site on July 2, 1923

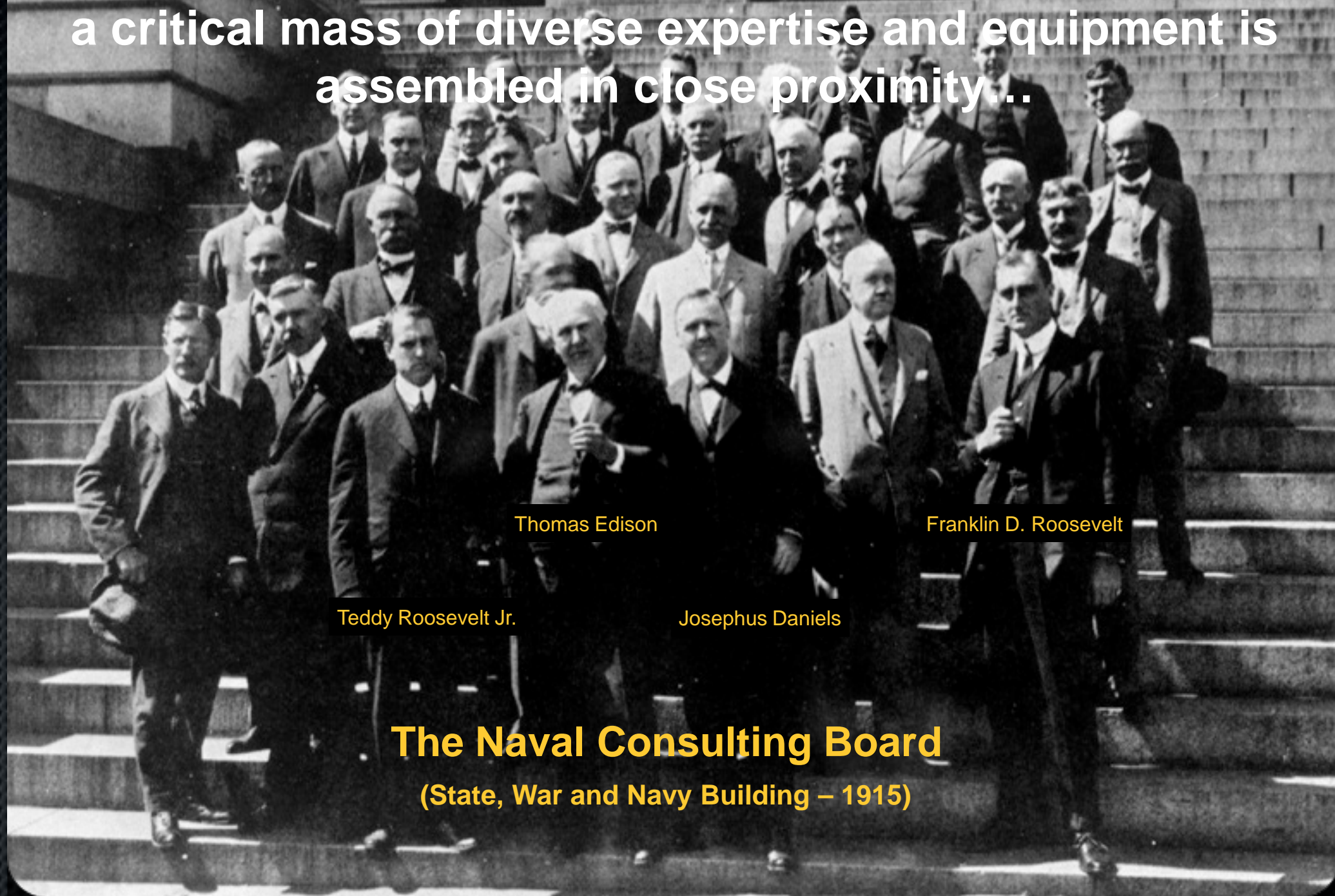
Establishment of NRL



# The Navy and Marine Corps Corporate Laboratory



**22 Initial members from 11 National science and Engineering societies, to illustrate what can happen when a critical mass of diverse expertise and equipment is assembled in close proximity...**



**The Naval Consulting Board**

**(State, War and Navy Building – 1915)**

**The Navy and Marine Corps Corporate Laboratory**



# NRL Mission

- To conduct a broadly based multidisciplinary program of scientific research and advanced technological development directed toward maritime applications of new and improved materials, techniques, equipment, systems and ocean, atmospheric, and space sciences and related technologies.
- Primary in-house research for the physical, engineering, space, and environmental sciences
- Broadly based applied research and advanced technology development program in response to identified and anticipated Navy and Marine Corps needs
- Broad multidisciplinary support to the Naval Warfare Centers
- Space & space systems technology development & support
- Designated as the Navy's corporate laboratory by SECNAV 1991

**From the bottom of the ocean floor to the far reaches of space ...**

**The Navy and Marine Corps Corporate Laboratory**



# Lines of Business

- Sensors, Electronics and Electronic Warfare
- Materials/Processes
- Battlespace Environments
- Air / Surface / Undersea Warfare
- Information Systems Technology
- Space Platforms
- Technology Transfer

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**Assistant Secretary of the Navy  
(Research, Development & Acquisition)  
The Honorable Sean Stackley**

**Chief of Naval Research  
RADM Matthew Klunder**

**Naval Research Laboratory**

**Commanding Officer  
CAPT. Anthony Ferrari, USN**

**Director of Research  
Dr. John Montgomery**

**Business Operations  
Mr. D. Therning**

**Systems Directorate  
Dr. G. Borsuk**

**Materials Science and  
Component Technology  
Dr. B. B. Rath**

**Ocean and  
Atmospheric  
Science & Technology  
Dr. E. Franchi**

**Naval Center for  
Space Technology  
Mr. P. G. Wilhelm**

**Radar  
Electronic Warfare  
Optical Sciences  
Information Technology**

**Chemistry  
Materials Science & Technology  
Comp. Phys & Fluid Dynamics  
Plasma Physics  
Electronics Science & Tech  
Biomolecular Science &  
Engineering**

**Acoustics  
Remote Sensing  
Oceanography  
Marine Geosciences  
Marine Meteorology  
Space Sciences**

**Space Systems Dev  
Spacecraft Engineering**

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# Naval Research Laboratory

Acreage	880
Buildings	200

Lab Buildings	\$1.9B
Special Facilities	\$1.6B
Equipment	\$0.5B
Replacement Value	\$4B

Unique and in some cases, one-of-a kind Lab Facilities

PATUXENT RIVER  
VXS-1 Squadron

VXS-1 Squadron

NRL D.C.

NRL D.C.

Chesapeake Bay Div  
Tilghman Is.  
Midway Res Ctr  
Blossom Point  
Pomonkey

KEY WEST  
Marine Corrosion  
Facility

MOBILE, AL  
Ex-USS Shadwell

BAY ST. LOUIS, MS  
John C. Stennis Space Center

\* Additional sites based on  
sponsor research

MONTEREY, CA

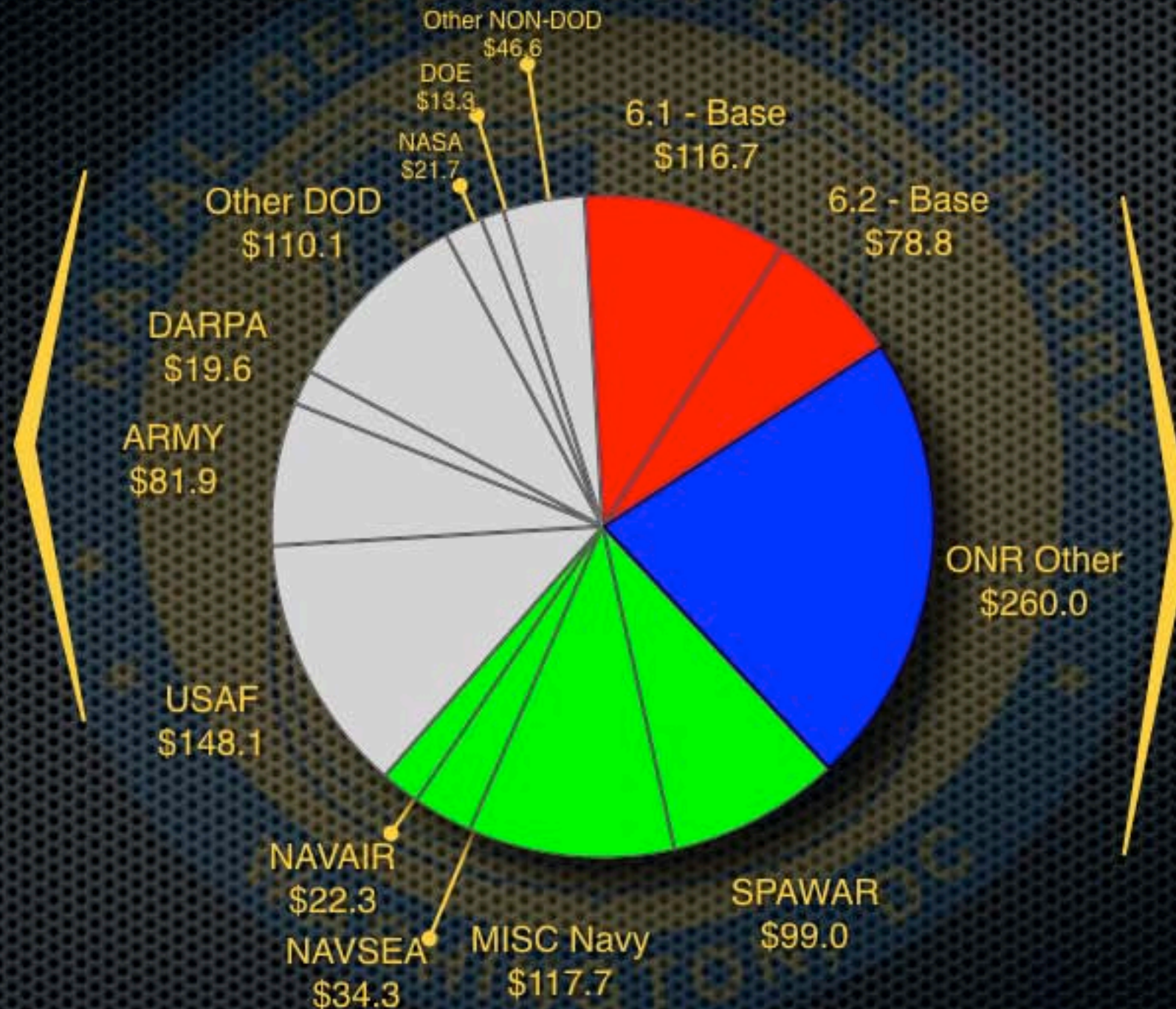


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# SPONSORS

FY11 Costs  
\$1,170.2 Million



Leveraging  
Joint funding for  
Navy needs

Navy Funding  
for Navy needs

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## Battlespace Environments (16%)

Environmental processes and phenomena of the ocean, sediment near shore and marine atmosphere

Barney and Long Ranger ADPCs



## Space Res. & Space Tech (8%)

Understand the space environment and its effects on Naval Systems. Conduct unique experiments in space, specific to future DON needs



## Information Technology (4%)

Science and technology for communications, information security, decision support, and autonomous systems.



Mobile Networks / Personal Secure Phone

## NRL S&T Base Program \$116.7M 6.1, \$78.8M 6.2 in FY11

- In-house Basic and Applied Research for the Physical, Engineering, Space, and Environmental Sciences
- Results to advance Naval Systems and Capabilities

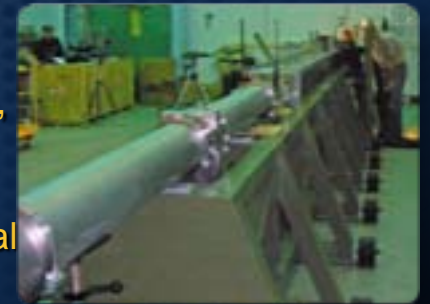
## Electromagnetic Warfare (13%)

Develops technologies for total electromagnetic battlespace awareness/dominance



## Electronics (18%)

Research leadership on new electronic and electro-optic phenomena, materials, theory and techniques for future Naval forces and avoid technological surprise



## Undersea Warfare (13%)

Research and advanced technologies for undersea sensors for ASW/MW



Undersea Distributed Surveillance

## Materials & Chemistry (25%)

Development of advanced functional and structural materials



NRL "GelMan" developed and implemented to determine internal brain dynamic responses under blast conditions

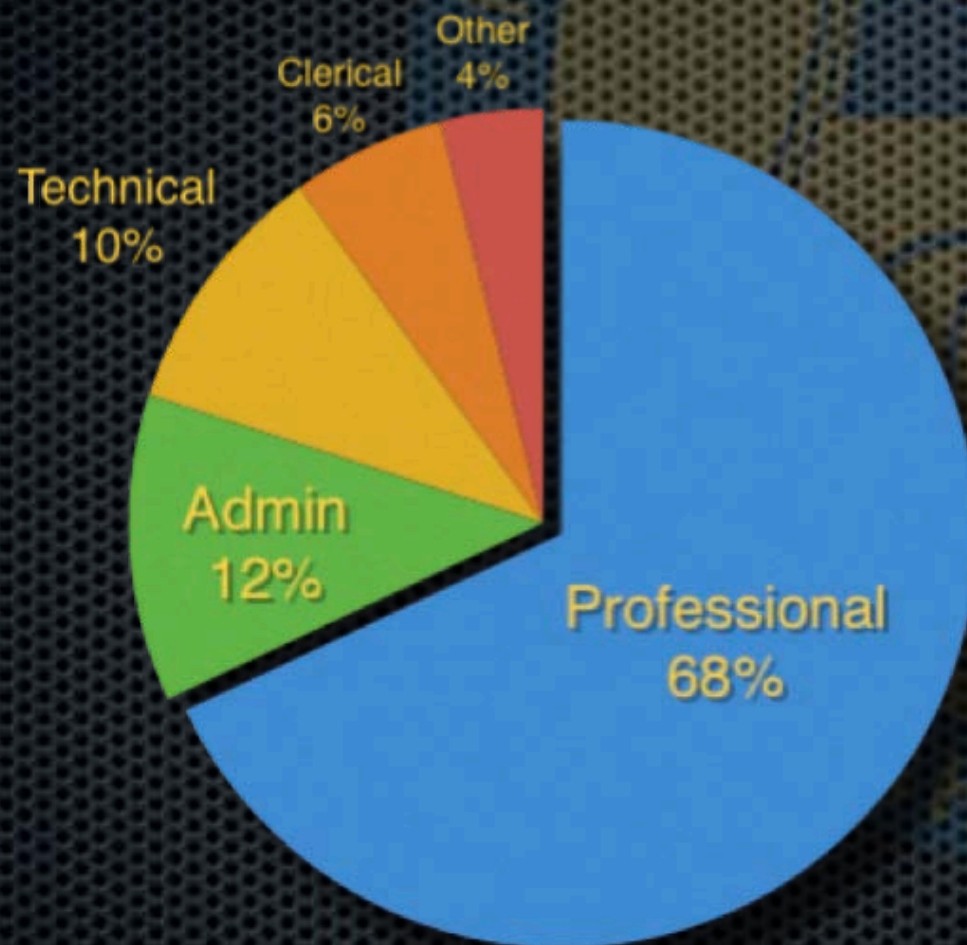


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## NRL Personnel FY 11 (Full Time Personnel)

Bachelor	540
Masters	353
Doctorate	817
<b>Total (including WG)</b>	<b>2321</b>



Physicists	375
Electrical Engineers	393
Computer Scientists	133
Other Engineers	111
Chemists	99
Mechanical Engineers	73
Aerospace Engineers	67
Oceanographers	58
Meteorologists	55
General Physical Scientists	43
Astronomers	35
Mathematicians	26
Biological Scientists	28
Metallurgists	9
*Other	33
<b>Scientists/Engineers:</b>	<b>1538</b>

\* other includes: Geologists, Operations Research Analysts, Health Physicists

**A diversity of expertise, co-located, with the ability to mix and match talents to solve new and difficult problems**

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# Institutional Programs In Support of NRL Research

- Post doctoral Program (~120-200 Postdoctoral Fellows)
  - A comprehensive process managed by the National Research Council & the American Society For Engineering Education (ASEE)
- Summer Faculty Program (~ 40 University Faculty)
  - Summer appointment (10 weeks)
  - Managed by ASEE
- Summer Student Program (200-400 students)
  - High School / undergraduate /graduate students
  - Naval Research Enterprise Intern Program
  - Student Career Experience Program
  - Student Temporary Employment Program
  - Student Volunteer Program
  - DoD S&E Apprentice Program (High School juniors)

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# NRL Partnerships

- Partnerships with Industry
  - Cooperative Research and Development Agreements (CRADA)
  - Sale to Third Parties (non-Federal Government)
  - Licensing/Sublicensing
- Partnerships with Universities
  - @1000 collaborations with 250 institutions in 50 states
  - 198 collaborations in 34 foreign countries
- International Agreements/Committees
  - Involvement with 44 nations
- Joint Programs
  - MOA/MOUs

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# Measures of S&T Excellence

Great Science, Right Science, Payoff for the Navy

## World Class Science

- Papers, patents, citations, royalties
- Nat'l Academy members, society fellows
- Percent of staff with PhD/advanced degrees
- Prestigious scientific and engineering awards

## High Value for DoN

- Transitions & quick responses
- BRAC military value rankings
- Studies by DSB, NDU, NRAC, NAS, etc
  - Outside customers

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# World Class Science

(Linkage between U.S. Scientific Research & Patents)

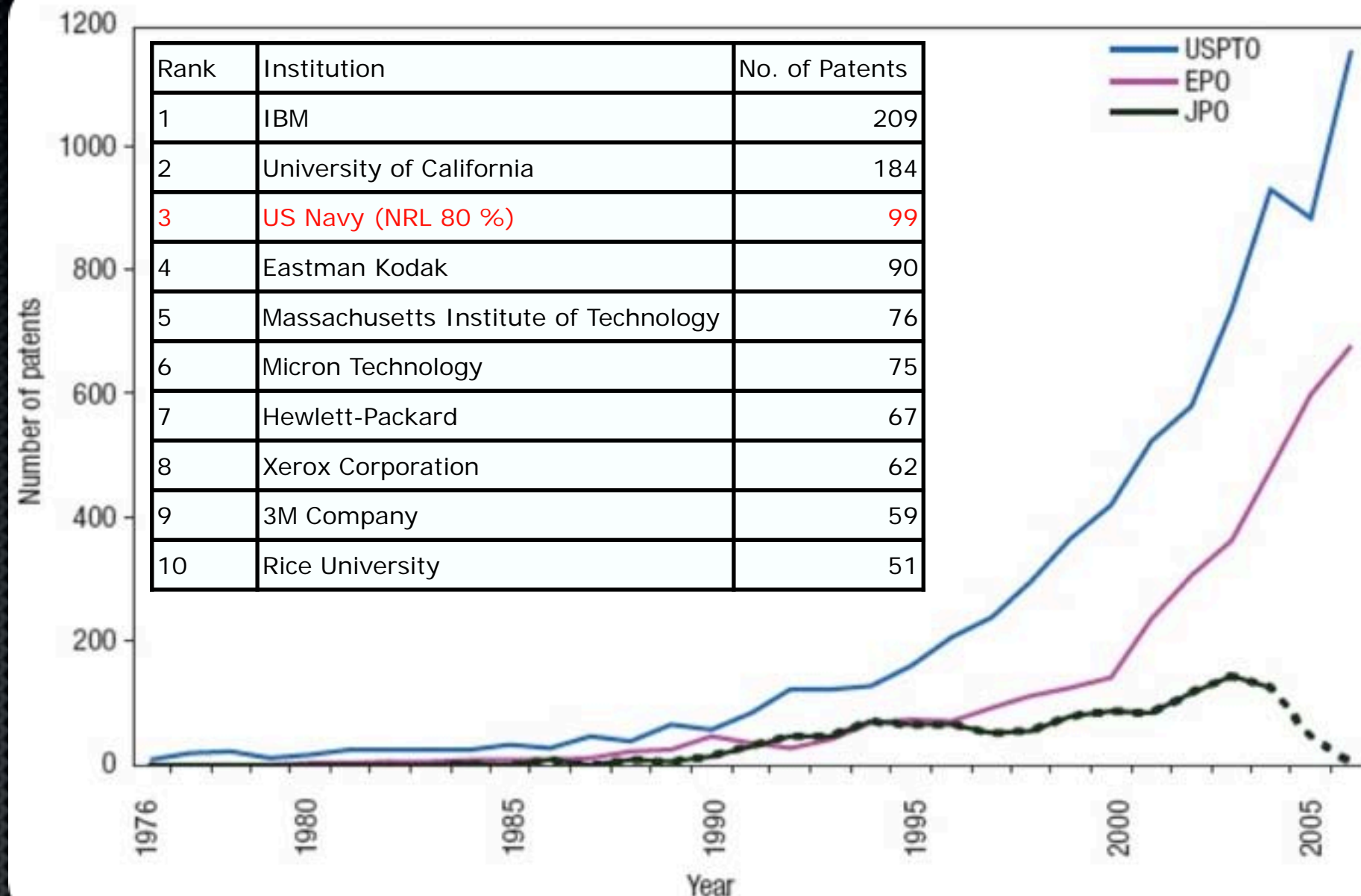
## Top Ten (of 430) U.S. Institutions in Rank Order (an NSF Study Research Policy)

Physics Papers
1. AT&T Bell Labs
2. IBM Corporation
3. Stanford University
4. Bellcore
5. Naval Research Laboratory
6. Lincoln Labs
7. MIT
8. University of Illinois
9. UC Santa Barbara
10. Cornell University

Engineering & Technical Papers
1. AT&T Bell Labs
2. IBM Corporation
3. University of CA Berkeley
4. MIT
5. Stanford University
6. General Electric Company
7. Texas Instruments
8. Naval Research Laboratory
9. UC Santa Barbara
10. Bellcore

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Top Ten Institutions for US Patents in Nanotechnology (1976-2006)  
Nature Nanotechnology, Vol. 3, March 2008

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# Cover Highlights in S&T Journals



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# National Academy Membership, 2009

	ANL	BNL	JPL	LANL	LLNL	IBM	NIST	NRL
NAE	3	2	6	4	3	17	10	6
NAS	3	9	0	5	0	11	5	3

## Advisors to the Nation ...

Distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the public good.

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NRL Commissioned  
1923



First radar installed  
on USS New York  
1939



Vanguard I launched  
1958



First U.S. intelligence satellite  
1960



Principles of modern  
fracture mechanics  
1947

Sound Navigation and  
Ranging (SONAR)

Plan-Position  
Indicator

Liquid Thermal  
Diffusion Process

Synthetic lubricants

Improved Aircraft Canopy

Deep Ocean Search

1920

1930

1940

1950

1960

Gamma-Ray Radiography

First U.S. radar  
patents

Submarine, airborne &  
OTH radars & IFF

First Detection of  
X-Rays from the Sun

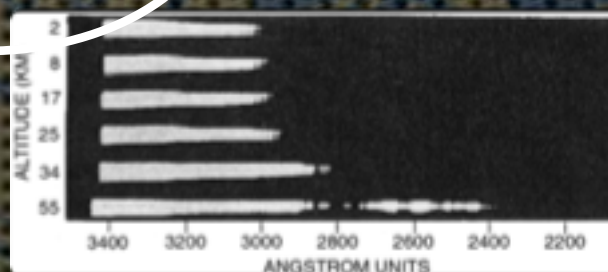
submarine life  
support

Over the Horizon Radar



Skip distance effect  
1925-1926

First concept & proposal for  
nuclear sub  
1939



First experiment in space  
1946



Purple K Powder  
1959



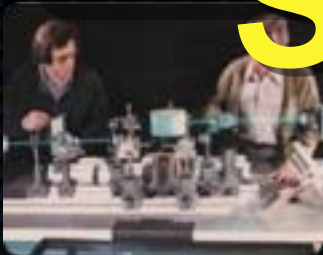
Aqueous Film Forming  
Foam  
1966

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# Significant and consistent contributions to the evolution of technological landscapes in both military and civilian venues

First fiber-optic acoustic biosensor  
1977



Permanent Magnets  
1980



Nobel Prize in Chemistry  
to Jerome Karle  
1985

Decadal Impact of  
El Nino discovered  
1994



SHARP Reconnaissance  
2001



Dragon Eye UAV  
2002

Lunar camera

Excimer laser

Advanced Narrowband  
Secure Voice Terminal

Extreme Ultraviolet  
Imaging Telescope

CBR sensors for Fleet  
& Homeland Security

ANDE-7 Spacecraft

1970

1980

1990

2000

2010

GPS prototype in orbit

(GaAs) production  
techniques

Blood Surrogate

Psec, IPv6, NKDS

Specific Emitter ID

Intrinsic Magnetism at  
Silicon Surfaces

Timing - GPS  
1964-1977



Navy operations: Global  
Atmospheric Model  
1982



NQR detection for  
explosives & narcotics  
1992



Clementine Spacecraft  
1991-1994



Windmill spacecraft  
2003



QuadGard  
2005



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## **Through Knowledge, Sea Power**

**22 Initial members from 11 National science and Engineering societies, to illustrate what can happen when a critical mass of diverse expertise and equipment is assembled in close proximity...**

**Facilities + Expertise + Structure to yield ...**

**A diversity of expertise, co-located with the ability to mix and match talents to solve new and difficult problems**

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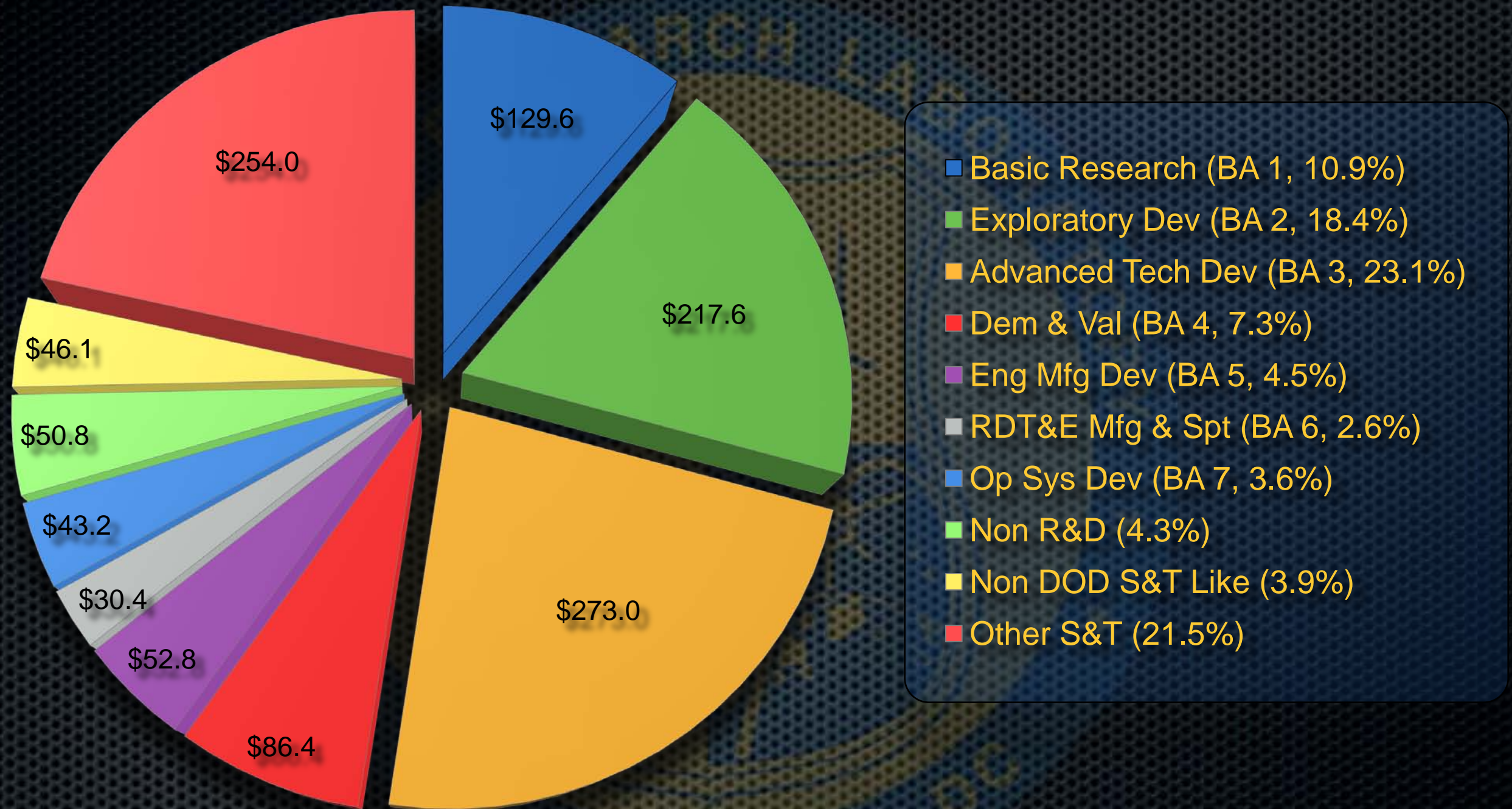


Establishment of NRL

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## R&D Categories



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Research Modified NP-3D	2
AEW Rotodome NP-3D	1
Research Modified RC-12	2
MZ-3A Airship	1
<b>Total Aircraft</b>	<b>6</b>



## Scientific Development Squadron ONE (VXS-1)

Provides airborne research capability to NRL-Sensor and system test bed,  
airborne surrogate-Worldwide deployable

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